

## THE WEATHER OF THE MONTH.

By ALFRED J. HENRY, Chief of Division of Records and Meteorological Data.

During the first ten days of the month the weather on the Pacific coast was rather warm and mild; east of the Rocky Mountains, however, it was cold and unseasonable, the unfavorable conditions of the previous month continuing. During this period (1st to 10th) two storms passed across the country from the Pacific to the Atlantic in rather low latitudes for the season. As a consequence abnormally cold weather and light to heavy frosts were experienced in Texas and the Gulf and South Atlantic States. The fall of snow in southern Virginia, North Carolina, Tennessee, and along the northern border of South Carolina on the 4th and 5th, occurred during the passage of the first of the above-named storms. The occurrence of snow in April as far south as the Carolinas is an event that does not happen more than half a dozen times in a century.

The weather moderated east of the Rocky Mountains after the 11th and for the remainder of the month the temperature was generally above normal, the excess being greatest in the Lake region. In the northwest, however, especially in Montana, temperature remained below normal during the greater part of the month, the average daily deficiency at Havre being about 6°. The continued low temperature in the Northwest was especially unfortunate for stockmen, in view of the fact that the winter had been one of almost unprecedented severity. In the Southwest and on the Pacific coast, south of Eureka, temperature was above normal for the month as a whole.

The general character of the month will be seen from a study of the following tables:

## TEMPERATURE OF THE AIR.

*Average temperatures and departures from the normal.*

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
New England .....	10	44.2	+ 0.9	- 1.3	- 0.3
Middle Atlantic .....	12	51.7	+ 1.0	- 4.7	- 1.2
South Atlantic .....	10	59.6	- 2.4	- 5.4	- 1.4
Florida Peninsula .....	7	58.8	- 2.2	- 2.3	- 0.6
East Gulf .....	7	64.0	- 2.4	-11.0	- 2.8
West Gulf .....	7	65.0	- 2.0	-10.2	- 2.6
Ohio Valley and Tennessee .....	12	57.2	+ 1.3	- 9.1	- 2.3
Lower Lake .....	8	48.9	+ 4.2	- 1.6	- 0.4
Upper Lake .....	9	48.9	+ 3.7	- 8.1	- 2.9
North Dakota .....	7	39.3	- 2.4	-15.7	- 3.0
Upper Mississippi .....	11	52.4	+ 1.2	-12.0	- 3.0
Missouri Valley .....	10	50.5	- 1.6	-14.7	- 3.7
Northern Slope .....	7	42.5	- 2.1	-20.7	- 5.2
Middle Slope .....	6	53.9	- 0.2	-13.6	- 3.4
Southern Slope .....	6	58.7	- 2.1	-13.6	- 3.4
Southern Plateau .....	13	59.9	+ 0.9	- 0.6	- 0.2
Middle Plateau .....	9	47.4	- 1.2	+ 1.1	+ 0.3
Northern Plateau .....	10	45.2	- 1.9	- 3.7	- 0.9
North Pacific .....	9	47.3	- 1.6	- 3.9	- 1.0
Middle Pacific .....	5	54.9	+ 0.5	+ 2.2	+ 0.6
South Pacific .....	4	58.9	+ 0.3	+ 2.1	+ 0.5

*In Canada.—Prof. R. F. Stupart says:*

The mean temperature of the month was above average in the Dominion everywhere east of a line drawn north and south through Winnipeg, and below average everywhere to the westward; the greatest excess was over the more central portions of Ontario, and the greatest departure below average (6°) was in Alberta and the more western parts of Saskatchewan and Assiniboia. The temperature was decidedly below average for the first ten days in all districts between the Great Lakes and the Maritime Provinces, then abnormally high temperature became prevalent, and during the last few days summer-like conditions obtained. In the Northwest Territories the month closed cold and disagreeable, and snow was reported in many localities.

## PRECIPITATION.

Precipitation was below normal. There was a small excess in a few districts, it is true, but as a general rule less than the normal amount of rain and snow fell. And this is also true for the whole country for the period January to April, both inclusive.

There was no snow on the ground at the close of the month except at mountain stations. The amount of snowfall at the latter, as determined by reports to section centers, was greater than usual, thus insuring a steady flow of water for irrigating purposes.

The numerical values of total precipitation and total depth of snowfall are given in Tables I and II, and the geographic distribution is graphically shown on Charts III and VIII.

*Average precipitation and departures from the normal.*

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		Inches.	Inches.
New England .....	10	1.84	57	-1.4	+1.6
Middle Atlantic .....	12	1.42	43	-1.9	-0.8
South Atlantic .....	10	3.10	91	-0.3	-0.8
Florida Peninsula .....	7	2.68	113	+0.4	+3.1
East Gulf .....	7	1.98	45	-2.4	-4.2
West Gulf .....	7	2.85	74	-1.0	-3.5
Ohio Valley and Tennessee .....	12	2.45	60	-1.6	+0.3
Lower Lake .....	8	1.11	48	-1.2	-1.1
Upper Lake .....	9	1.78	78	-0.5	-2.2
North Dakota .....	7	1.27	64	-0.7	-1.6
Upper Mississippi .....	11	2.26	76	-0.7	-1.3
Missouri Valley .....	10	2.06	67	-1.0	-2.1
Northern Slope .....	7	0.85	52	-0.8	-0.1
Middle Slope .....	6	1.89	67	-0.7	-1.8
Southern Slope .....	6	2.13	110	+0.2	-2.5
Southern Plateau .....	9	0.25	71	-0.1	-1.5
Middle Plateau .....	13	0.71	88	-0.1	+0.6
Northern Plateau .....	10	1.21	92	-0.1	-0.3
North Pacific .....	9	5.60	116	+1.0	+4.0
Middle Pacific .....	5	0.84	34	-1.6	-1.4
South Pacific .....	4	0.59	42	-0.8	-1.9

*In Canada.—Professor Stupart says:*

The precipitation was less than average throughout the Dominion, except in eastern Manitoba and north of Lake Superior, and perhaps on Vancouver Island. Rain is now needed in southwestern Ontario and on the northwestern prairie lands, but elsewhere the ground has been well watered by melting snow and thundershowers.

## SLEET.

The following are the dates on which sleet fell in the respective States:

Alabama, 8. California, 23. Colorado, 23. Connecticut, 7, 12. Idaho, 1, 4, 17, 18, 27. Illinois, 8. Kentucky, 3, 4, 8, 9. Louisiana, 5. Massachusetts, 7, 8, 12, 16, 21, 25. Michigan, 17. Minnesota, 5, 20. Mississippi, 8. Missouri, 2, 3, 8. Nebraska, 2, 3, 8. Nevada, 24, 25, 26, 27, 28. New Hampshire, 12, 14, 16. New Jersey, 16. New Mexico, 4, 5, 29. New York, 7, 8, 17. North Carolina, 4, 5, 6. North Dakota, 13, 14, 15, 17, 19, 28. Oregon, 23, 24, 27, 29, 30. Pennsylvania, 7, 8, 16. South Carolina, 4. South Dakota, 17. Tennessee, 3, 4, 8. Utah, 2, 18, 26, 27. Vermont, 12, 14. Washington, 3, 21. West Virginia, 7, 11.

## HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 8, 23, 24. Arizona, 4, 29. Arkansas, 3, 5, 6, 8, 15, 20, 27, 28. California, 23, 24, 25, 26, 27, 30. District of

Columbia, 16. Georgia, 7, 8, 24, 25. Idaho, 2, 27. Illinois, 15, 20, 29, 30. Indiana, 12, 28, 29. Indian Territory, 6, 18. Iowa, 13, 19, 21, 22, 27, 29, 30. Kansas, 7, 8, 13, 15, 17, 18, 19, 20, 25, 26, 27, 29, 30. Kentucky, 8, 9, 24, 25, 28. Louisiana, 20. Massachusetts, 14. Michigan, 12, 13, 14, 18, 28, 29, 30. Minnesota, 13, 26, 27, 30. Missouri, 3, 13, 17, 19, 20, 21, 26, 27, 29. Montana, 25, 26. Nebraska, 2, 8, 19, 25, 26, 27, 29, 30. New Hampshire, 21, 25. New Mexico, 4, 5, 20. New York, 12, 25, 30. North Carolina, 4, 7, 8, 25, 26. North Dakota, 26, 27. Ohio, 8, 12, 25, 28. Oklahoma, 5, 17, 18, 19, 20. Oregon, 12, 16, 17, 18, 20, 21, 22, 23, 26, 27, 28, 29, 30. Pennsylvania, 16, 26. South Carolina, 25. South Dakota, 15, 26, 27, 30. Tennessee, 3, 8, 19, 24, 25. Texas, 5, 16, 20. Utah, 2, 16, 19, 27, 28, 29. Virginia, 16, 24, 25. Washington, 2, 3, 4, 6, 9, 10, 12, 15, 16, 17, 18, 21, 22, 25, 26, 27, 28, 29, 30. West Virginia, 7. Wisconsin, 15, 27, 28, 29.

### HUMIDITY.

The relative humidity of the Pacific coast, Plateau, and Rocky Mountain regions, was uniformly below normal, even in districts having a heavy rainfall.

*Average relative humidity and departures from the normal.*

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England .....	88	-4	Missouri Valley .....	88	+1
Middle Atlantic .....	73	+1	Northern Slope .....	58	+1
South Atlantic .....	74	+1	Middle Slope .....	54	+1
Florida Peninsula .....	75	+1	Southern Slope .....	52	+1
East Gulf .....	75	+1	Southern Plateau .....	53	+1
West Gulf .....	75	+1	Middle Plateau .....	42	+3
Ohio Valley and Tennessee .....	65	+1	Northern Plateau .....	53	+1
Lower Lake .....	67	+1	North Pacific Coast .....	75	+4
Upper Lake .....	76	+1	Middle Pacific Coast .....	71	+3
North Dakota .....	70	+1	South Pacific Coast .....		
Upper Mississippi .....	67	+1			

### WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

*Maximum wind velocities.*

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex .....	27	60	w.	Mount Tamapals, Cal. ....	29	72	nw.
Do. ....	30	64	sw.	Do. ....	30	75	nw.
Cape May, N. J. ....	7	60	e.	Do. ....	30	75	nw.
Carson City, Nev. ....	18	60	w.	New York, N. Y. ....	29	50	nw.
Do. ....	27	50	sw.	Do. ....	29	50	e.
Cheyenne, Wyo. ....	17	53	nw.	Do. ....	17	50	e.
Chicago, Ill. ....	28	50	s.	Pierre, S. Dak. ....	17	60	nw.
Do. ....	29	52	s.	Do. ....	29	52	nw.
Dodge, Kans. ....	30	61	sw.	Point Reyes Light, Cal. ....	16	53	nw.
El Paso, Tex. ....	20	50	n.	Do. ....	16	56	nw.
Fort Canby, Wash. ....	10	52	s.	Do. ....	16	60	nw.
Do. ....	17	50	se.	Do. ....	21	63	nw.
Hatteras, N. C. ....	4	57	n.	Do. ....	21	70	nw.
Huron, S. Dak. ....	28	52	nw.	Do. ....	28	55	nw.
Independence, Cal. ....	23	52	se.	Do. ....	28	55	nw.
Miles City, Mont. ....	17	54	nw.	Do. ....	29	52	nw.
Mount Tamapals, Cal. ....	10	50	n.	Do. ....	30	60	nw.
Do. ....	15	84	nw.	Pueblo, Colo. ....	30	54	nw.
Do. ....	16	72	n.	Salt Lake City, Utah. ....	16	51	nw.
Do. ....	17	65	n.	Sioux City, Iowa. ....	18	54	nw.
Do. ....	18	66	n.	Do. ....	23	60	s.
Do. ....	21	78	nw.	Do. ....	30	50	se.
Do. ....	22	78	nw.	Winnemucca, Nev. ....	30	52	sw.
Do. ....	23	62	nw.				

### LOCAL STORMS AND TORNADOES.

Tornadoes and severe local storms occurred in northern Missouri, western Iowa, and central Nebraska, the storms being distributed over four dates, viz: 19th, 26th, 27th, and 30th.

Fifty-one persons were killed outright or received injuries from which they have since died, and probably 200 received serious wounds. The property loss was about \$300,000.

The tornado which struck the town of Kirksville, Mo., about 6:10 p. m., central time, on the 27th, must take rank as one of the most severe tornadoes of modern times. Outside of the immediate vicinity of Kirksville there was but little damage from this storm, the path of great destruction being confined to a narrow strip in the town proper, about 800 feet in width, and probably a mile and a half long. In this short distance about 300 buildings were totally or partially destroyed and 34 lives lost. The storm seems to have been unusually short-lived considering its violence.

To the northeastward, in Knox County, high winds and rain were general, but no funnel cloud was observed.

Three separate and distinct tornadoes were observed a little earlier in the day to the westward of Kirksville, illustrating the tendency of tornadoes to form almost simultaneously north and south of each other, and move northeastward in parallel paths. One of the tornadoes thus observed struck the village of Newtown, Sullivan County, causing a loss of 12 lives.

The tornado observed in Holt County, Mo., on the 19th, moved a little west of north, a very unusual course. Its course is authenticated by Voluntary Observer William Kaucher, of Oregon, Mo. During the latter part of the season of 1898 a number of cases of tornadoes moving from northwest to southeast occurred, and movements due east are not uncommon. We rarely, however, find one moving toward a westerly quarter.

### SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

*Average cloudiness and departures from the normal.*

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England .....	4.0	-1.3	Missouri Valley .....	5.2	-0.2
Middle Atlantic .....	4.5	-0.7	Northern Slope .....	5.0	-0.4
South Atlantic .....	5.0	+0.6	Middle Slope .....	4.2	-0.2
Florida Peninsula .....	4.2	+0.3	Southern Slope .....	5.1	+0.9
East Gulf .....	4.5	0.0	Southern Plateau .....	2.8	+0.5
West Gulf .....	5.6	+0.4	Middle Plateau .....	4.9	-0.4
Ohio Valley and Tennessee .....	5.4	+0.1	Northern Plateau .....	5.9	-0.4
Lower Lake .....	5.0	-0.5	North Pacific Coast .....	7.0	+0.5
Upper Lake .....	5.4	-0.3	Middle Pacific Coast .....	4.2	-0.4
North Dakota .....	4.5	-1.0	South Pacific Coast .....	3.4	-0.5
Upper Mississippi .....	5.3	-0.2			

### ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table VII, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

*Thunderstorms.*—Reports of 1,962 thunderstorms were received during the current month as against 1,505 in 1898 and 2,125 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 25th, 230; 30th, 201; 27th, 187; 26th, 177.

Reports were most numerous from: Iowa, 172; Ohio, 164; Michigan, 163; Missouri, 140.

*Auroras.*—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, 20th to 29th.

The greatest number of reports were received for the following dates: 9th, 7; 6th, 5; 4th and 11th, 4.

*In Canada.*—Auroras were reported as follows: Yarmouth, 19th; Father Point, 5th, 6th, 7th, 11th; Quebec, 3d, 4th, 6th, 9th, 10th, 24th; Kingston, 2d; Minnedosa, 10th, 12th, 16th, 25th, 30th; Qu'Appelle, 5th, 6th, 7th; Medicine Hat, 9th; Swift Current, 7th, 9th, 10th; Battleford, 24th.

Thunderstorms were reported as follows: Quebec, 30th; Toronto, 11th, 13th, 14th, 30th; White River, 14th, 27th, 29th;

Port Stanley, 14th, 30th; Sangeen, 13th, 14th, 30th; Parry Sound, 14th, 30th; Port Arthur, 25th, 27th; Winnipeg, 24th, 26th; Battleford, 11th; Esquimalt, 21st.

#### WEATHER OF THE WEST INDIES.

There was little rain, the dry season being well marked at a majority of stations, San Juan, Porto Rico, and Santo Domingo being the notable exceptions. Rains were exceedingly light at Curaçao, Colon, and Port of Spain.

Heavy sea swell from the south and southeast was observed at St. Kitts on the 21st, 22d, 23d, 24th, and 26–30th; also at Santo Domingo on the 28–29th.

The distribution of pressure, temperature, and the resultant winds for March and April are shown on Charts IX and X, respectively, being a continuation of the series begun in the March, 1899, REVIEW.

### DESCRIPTION OF TABLES AND CHARTS.

By ALFRED J. HENRY, Chief of Division of Records and Meteorological Data.

Table I gives, for about 130 Weather Bureau stations making two observations daily and for about 20 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (....).

Table III gives, for 26 stations selected out of 113 that maintain continuous records, the mean hourly temperatures deduced from the Richard thermographs described and figured in the Report of the Chief of the Weather Bureau, 1891–92, p. 29.

Table IV gives, for 26 stations selected out of 104 that maintain continuous records, the mean hourly pressures as automatically registered by Richard barographs, except for Washington, D. C., where Foreman's barograph is in use. Both instruments are described in the Report of the Chief of the Weather Bureau, 1891–92, pp. 26 and 30.

Table V gives, for about 130 stations, the arithmetical means of the hourly movements of the wind ending with the respective hours, as registered automatically by the Robinson anemometer, in conjunction with an electrical recording mechanism, described and illustrated in the Report of the Chief of the Weather Bureau, 1891–92, p. 19.

Table VI gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table VII gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table VIII gives, for about 70 stations, the average hourly sunshine (in percentages) as derived from the automatic records made by two essentially different types of instruments, designated, respectively, the thermometric recorder and the photographic recorder. The kind of instrument used at each station is indicated in the table by the letter T or P in the column following the name of the station.

Table IX gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes..	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates pr. hr. (ins.)..	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table X gives the record of excessive precipitation at all stations from which reports are received.

Table XI gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

#### NOTES EXPLANATORY OF THE CHARTS.

Chart I, tracks of centers of high areas, and Chart II, tracks of centers of low areas, are constructed in the same way. The roman numerals show number and chronological order of highs (Chart I) and lows (Chart II). The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. Within each circle is also given (Chart I) the highest barometric reading and (Chart II) the lowest pressure at or near the center at that time.

Chart III.—Total precipitation. The scale of shades show-